Three-Dimensional Roller Locking Sprag

NASA offers companies the opportunity to license this fundamentally superior sprag design for use in brakes and clutches.

Originally developed at NASA Goddard Space Flight Center, this technology provides a solution to torque-coupling locking brake and clutch applications that are too demanding for conventional sprag brakes/clutches. NASA's 3-D roller locking sprag brake/clutch provides superior holding torque at a reduced size and weight. This innovative sprag geometry offers benefits to numerous commercial applications.

Benefits

- ***Compact***: Significantly reduced diameter and shorter axial length than conventional roller locking brakes/clutches
- ***Lightweight***: Less material mass required to achieve a given holding torque
- ***Strong***: Resistant to bending deformation due to significantly lower contact stresses by using grooved flange cross-sections
- ***Efficient***: Increased locking effectiveness and increased torque output over other brake/clutch devices
- ***Durable***: Minimal generation of particles and other wear products, superior lubrication paths, and moderate contact stresses

Commercial Applications

- ***Robotic joint brakes***: NASA uses the 3-D roller locking sprag on its Ranger Flight Experiment Robot.
- ***Over-running clutches***: Roller-type brakes/clutches are commonly used in high-performance aircraft, helicopters, automotive transmissions, lawn and garden equipment, tools, and small engines.
- ***Mechanical indexers***: The 3-D roller locking sprag can prevent reverse drive rotation on inclined conveyors, cranes, elevators, and other equipment.

National Aeronautics and Space Administration

The Technology

Many machines with rotating parts use brakes and clutches to stop or control the degree and direction of motion of the driven parts. Brakes and clutches often are incorporated between concentric races (i.e., rotating shafts). One class of locking brake/clutch uses spherical balls or cylindrical rollers located between an inner and outer race. At least one of the races contains cam surfaces against which the balls or rollers wedge and lock to produce instantaneous torque coupling. A variation on this approach incorporates the cam shape into the roller (i.e., sprag), which rotates through a small angle to engage the sprag's cam surfaces against the concentric cylindrical surfaces of the inner and outer races. Springs often are used to preload the sprags against the race surfaces so that the sprags engage and disengage instantly with no backlash.

NASA's innovative 3-D roller locking sprag has a tapered periphery and replaces the concentric, cylindrical surfaces of the inner and outer races of the brake/clutch with grooves into which the 3-D sprag fits. This geometry creates four points of locking contact—two between the outer taper of the 3-D sprag and the outer grooved race, and two between the inner taper of the 3-D sprag and the inner grooved race—twice as many as with conventional, simple ball-based roller locking brakes/clutches. The two additional contact points increase the locking efficiency of the device while reducing the level of sprag-to-race contact stresses. In conventional cylindrical roller sprags, the roller contacts the races along the full length of the roller sprags. However, NASA's 3-D roller locking sprag contacts only the diametrically opposing sides of the grooved races at the four points noted above, reducing contact stress and increasing holding power.

Partnering Opportunities

This technology is part of NASA's technology transfer program. The program seeks to stimulate commercial use of NASA-developed technologies. This technology has been patented (U.S. Patent 5,482,144) and prototypes have been built. NASA invites commercial companies to license the 3-D roller locking sprag technology for use in commercial applications.

For More Information

If you are interested in licensing this technology or if you would like more information, please contact:

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